

THE EARLIEST BIRDS

by

MARIE B. PABST

Raymond Foundation



Museum Stories, Number 131

October 5, 1946

The Earliest Birds

Birds are rather fragile creatures compared with other backboned animals. Their skeletons are light and often



Archaeopteryx, the earliest known bird. Notice the feathers growing from the side of the tail.

they are eaten by animals, who tear the body to pieces. So bird skeletons are seldom preserved as fossils.

Today there are about 25,000 different kinds of birds and only about 1,000 species of fossil birds. Scientists believe that before the last Great Ice Age there were many more kinds of birds than there are today. Many birds now found only in warmer regions once lived as far north as Nebraska and France. More recently, with the increase of man on earth, the varieties of birds have been reduced in number and some kinds exterminated.

The earliest birds that are known were found in a limestone quarry at Solenhofen, Bavaria. *Archacopteryx*, meaning "ancient feather," was first known by only an imprint of one feather on a bit of hardened mud. Later in the same quarry an almost complete fossil was found. A second complete skeleton was found of a very similar bird now known as *Archaeornis* ("ancient bird").

At the time these birds lived, southern Germany had shallow seas on whose shores grew cycads, giant ferns and pine trees. The birds' bodies fell on the mud flats and were buried in fine sediments. Sometimes other animals such as the *Pterodactyls* (flying reptiles), dragonflies, and *Ichthyosaurs* (fish-like reptiles) were also buried in the mud to be preserved as fossils.

These earliest known birds were about the size of crows. If it were not for the feathers one might think they were reptiles, so closely do their bodies resemble those of some of the reptiles. Each had a long tail with feathers growing from both sides. In a modern bird the tail is short and the tail feathers are arranged in fan fashion. *Archacopteryx's* long jaw was lined with teeth.

The next record of fossil birds comes from Kansas. The two birds *Hesperornis* and *Ichthyornis* lived 75,000,000 years ago when the interior of our country was a wide sea, and both these birds were equipped for aquatic life. *Hesperornis* was a diving bird with a body over five feet long, and powerful hind legs. Of all birds known he was most highly developed for life in the water. *Ichthyornis* (fish bird) was in some ways quite like the modern gull, having strong wings. He still possessed teeth in the rear of the mouth but the forward portion of the upper jaw had a bill.

Gradually birds developed into forms more like those known today. The toothed varieties disappeared and birds developed bills.

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A SILURIAN SEA

by

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A Silurian Sea

About 350,000,000 years ago northern Illinois was covered by a sea. As far as the horizon there was only a stretch of water which lay quiet under the sun. The surface was broken at times by waves that exposed



A fossil trilobite from the Chicago Region.

coral reefs; otherwise there was nothing to be seen but the water and the sky. This was before the time of birds or dinosaurs or any land-inhabiting vertebrate animals.

These corals forming the reefs that protruded from the water were large communities of small animals. The animals were fastened in one place and were unable to move from one spot to another. A single coral animal was a soft-bodied creature with tentacles about a mouth which was located at the end of a tube-like body. The walls of the body were pleated so that actually the animal was much broader than it appeared. About and beneath its body each coral built a wall composed of calcium. The material for constructing this wall was obtained from the sea water. These walls were the foundation for the coral's home, and the coral lived on top of the last floor that had been built. The

coral reefs grew higher and wider until some were fifty miles wide and hundreds of miles long.

Today, reef-building corals live in shallow water in tropical and semi-tropical regions. They grow best just below the level where the low tide might expose them. Whether ancient reef-building corals required these same conditions, we do not know.

Crawling about in the mud on the sea floor were curious little animals called trilobites that no longer exist today. They have left no descendants; but the crab, crayfish, shrimp, and lobster are distant relatives of these animals that have been extinct for over 200,000,000 years.

The name "trilobite" refers to the fact that the body is divided into three lobes or sections by two grooves that run lengthwise.

The trilobite's body was covered with a horny shell, known as the exo-skeleton. This hard coat could not expand as the trilobite grew larger, and it became necessary for it to discard its suit and have a new one at frequent intervals. To get a larger covering, the trilobite molted as does a modern caterpillar. The old skin would slit, the unprotected animal would crawl out, expand to its new increased size, and wait in concealment until the new covering hardened.

The remains of the coral reefs, trilobites, and many other animals are found as fossils in the limestone rocks that underlie the Chicago Region. These fossils are part of the evidence for the statement that 350,000,000 years ago where the city of Chicago now stands there was only a vast inland sea with nothing to be seen but the water and the sky.

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ANCIENT AMERICAN HORSES

by

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October 19, 1946

Ancient American Horses

The principal fact that emerges from study of pre-historic life is that living things, plant or animal, change. Either they adapt themselves to new conditions, or they become old-fashioned and soon die out. Sometimes the changes can be traced through many series of fossil bones from an ancient animal to its modern descendant. Step by step can be seen the changes of one kind or another that result in the animal of today. This development is well illustrated in the history of the horse. Fossil remains of horses have been found in rocks of different ages; these fossils show the changes that have taken place in this family, from a little, unspecialized animal to the large, highly specialized horse of today.

Horses of today differ from their ancestors in many respects, the most notable of which are greatly increased size, more complex teeth, and highly modified feet.

Modern horses walk on the tip of one toe. Their toe nail has become thickened and transformed into a hoof. Their high-crowned cheekteeth have broad, complicated surfaces ideal for chewing tough grasses. Modern horses are five or six times as large as their early ancestors.

The earliest horse whose skeleton has been found is called *Eohippus*, meaning "dawn horse." It has been found in Wyoming, Colorado, and New Mexico in rocks at least 55,000,000 years old. *Eohippus* was a small animal about the size of a cat and had a short head and a short, rounded body. The legs were short, and there were four toes on the front feet and three functional toes on the hind feet, with vestiges of two more. Food probably consisted of soft plants. The

Four stages in the development of the horse. The earliest known horse (left) was about the size of a cat, but through the years horses have greatly increased in size.

55,000,000 years ago



35,000,000 years ago



7,000,000 years ago



teeth were low-crowned and comparatively simple in structure.

About 35,000,000 years ago there lived a little horse, now known as Mesohippus, or "middle horse"; it was about the size of a collie and was light-weight and slender. A horse's only way of protecting itself is by running. It has no claws or long, sharp teeth with which to defend itself; so it runs away from danger. Any animal when it runs throws its weight forward on its toes. In the horses, the transformation of the toe nails into thick hoofs served to absorb some of the shock of running over hard ground. Mesohippus ran on its three middle toes. The two outermost toes were not used and had disappeared. So Mesohippus was a three-toed horse.

Our modern horses have reduced the number of toes even more, walking on but one—the third, or middle toe. Up inside the modern horse's leg are two long, slender bones, called splint bones, that are the remains of its second and fourth toes.

Many different kinds of one-toed horses lived in our country before the Great Ice Age. After the time of the glaciers, about 15,000 years ago, horses disappeared in America, and they did not return until the Spanish explorers brought them back.

The modern horse



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AN ANCIENT FOREST

by

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Museum Stories, Number 134

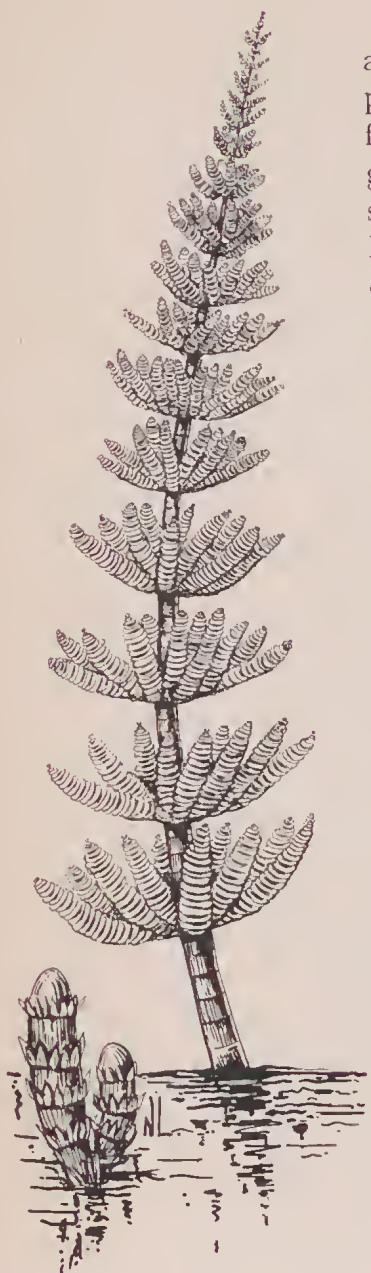
October 26, 1946

An Ancient Forest

In many parts of the world are rich coal beds formed from plants that grew in jungle-like forests long ago. The forests grew in fresh-water swamps that stretched for miles across the land. The mild damp climate of those days was ideal for plant growth and the many kinds of plants grew rapidly. The trees grew as tall as do our common trees today. Many of the tree trunks found in the coal beds are very large and some have long snaky roots that extend many feet from the trunk; so the trees must have been of considerable size.

These ancient trees did not look like our modern trees. In some ways they resembled very tall ferns. Some had leaves that were delicately cut, like fern fronds, and some of these fern-like leaves were over five feet long. Other trees had leaves that were long and ribbon-like. None of the trees had flowers, for there were no plants with flowers in those days. All the trees looked quite unlike the trees in modern forests. There were vines and shrubs, too.

In this ancient coal forest there were no brightly colored



Calamites, one of the common plants of the ancient coal forests.

birds, no snakes, no tigers or elephants. Most of the animals still lived in the sea. The only land animals with backbones were amphibians. They resembled our present-day salamanders and frogs. When young they lived in the water and looked like fish, but when they were adults they could live on land and walk about on feet. The swamps were ideal homes for these animals and there were many kinds of amphibians in the forests. During the age of the coal forests these animals were the most important of all the animals that lived on land, just as in later ages the dinosaurs were the most important of all the land animals.

Besides the amphibians, there were many insects in the forests. There were large dragonflies, larger than any that live today. One dragonfly found in the coal beds of Belgium had a wing spread of twenty-nine inches. The dragonfly is the largest insect, as far as we know, that has ever lived on the earth.

The most common of the insects were the cockroaches. They fed on almost anything—plants, decaying animal matter, or rotting vegetation. When these swamp plants died, they toppled over gradually and pushed down into the oozy bog. More tree trunks, leaves, and plant parts dropped into the swamp constantly until there must have been a great accumulation. During the years that followed, the plants thus buried in the swamp underwent many chemical changes and formed peat, the first stage of coal. After many more years, perhaps millions, as the chemical changes continued and the plants were subjected to pressure too, the peat became brown coal and then soft or bituminous coal and last of all hard or anthracite coal.

Whatever the kind of coal that is being burned today, it is the remains of plants that grew in an ancient forest many years ago.

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ANIMALS OF THE TAR POOLS

by

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Raymond Foundation



Museum Stories, Number 135

November 2, 1946

Animals of the Tar Pools

One of the richest collections of fossil animals that has ever been found comes from the tar pits that now are in a city park of Los Angeles. Bones of thousands of individuals have been removed from pits and they



SABRE TOOTH TIGER

The sabre tooth tiger was a frequent visitor to the tar pits, for it hoped to find a trapped animal to eat. Very often sabre-tooth also was caught in the tar.

give a wonderfully complete picture of the vertebrate animals that once inhabited the Pacific coast.

The tar pits are located in a region where layers of rock containing oil are numerous and fairly near the surface. Often associated with the oil is considerable gas. It is believed that this gas at times caused blowouts in the thin layers of rock above the oil-bearing rocks. The pressure of the gas forced upward, formed cuplike depressions from fifteen to thirty feet across and about the same depth. Oil mixed with sand filled the hole. The oil thickened as it was exposed to the air, and then layers of dust drifted across its surface. Sometimes, after a rain, water would stand in a shallow pool over the oil.

It is believed the animals were caught in the tar pits during dry weather. They were deceived by the water over the pools. The large ground sloths, horses, camels, and imperial mammoths came to drink and, not knowing about the treacherous tar below, waded into the supposed water hole. They began to sink and, once caught, their struggles to free themselves were useless. They only sank deeper into the pool. The cries of the trapped animals attracted wolves, sabre tooth tigers, and lions. These meat eaters quarreled among themselves as they fed on the mired beasts and, losing caution, they too were trapped. Finally, there came the carrion eaters, the eagles, condors, and giant vultures to feast on the spoils, but they in their turn were caught in the tar.

The oil preserved the bones. As the flesh and ligaments decayed, the bones sank and became separated from each other. The rising gas bubbles and the struggles of later victims caused the bones of the individual skeletons to be scattered. Scientists have removed from the tar pits vast numbers of separate bones, sorted them out, and decided to what sort of animal they belonged.

The commonest kind of animal caught in the pits was the dire wolves but the most famous of all the animals is the sabre tooth tiger that looked something like an enormous wildcat. It was not as large as a modern tiger or lion and was neither a fleet runner nor a graceful animal. The limbs were short and muscular and possessed tremendous power. The long canine teeth were used as stabbing weapons and were useful in ripping open the flesh of the prey.

It would take a long time to describe and list all the animals that have been found in the tar pools. There were over sixty kinds of birds. The carrion and flesh eaters were the most common. One, the giant vulture, was larger than modern condors and is the largest flying bird that has ever lived.

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MAMMOTHS AND MASTODONS

by

WINONA HINKLEY

Raymond Foundation

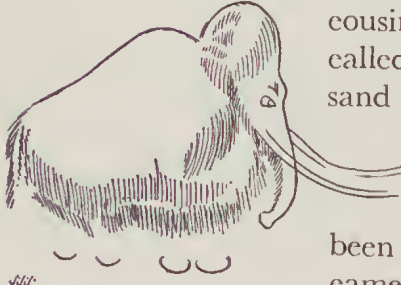


Museum Stories, Number 136

November 9, 1946

Mammoths and Mastodons

If you wanted to see a wild elephant today, you would have to go to Africa or India; but if you had lived here some fifty thousand years ago, they would have been your neighbors. The last of the mammoths



An ancient artist's sketch of the woolly mammoth

and mastodons, as the prehistoric cousins of our elephants are called, died some twenty thousand years ago. This was about the time the great glacier disappeared from this region, and it may have been before the first Indians came to our country.

Like the elephants, these prehistoric animals must have lived entirely upon plant life, for their teeth are constructed for crushing and grinding. In some skeletons there are even traces of leaves between the teeth. The mammoths, like the elephants, had just four teeth, which in the largest species sometimes were as much as a foot long and nine inches high. Tusks are over-grown incisors, and one famous mammoth tusk is twelve feet long and two feet around at the thickest part.

Most of our knowledge of prehistoric animals comes from study of the actual bones which have been preserved in the ground through the centuries. For these animals there is usually no way of knowing the nature of the skin or skin covering. But in the case of the Northern Mammoth, even though the early cave men are the only people who ever saw one, we know that he had a woolly coat about an inch thick with an outer coat of darker coarse hair over a foot in length. A number of these mammoths which have been buried in the frozen earth of Siberia for thousands of years are preserved as perfectly as if they had died only yesterday.

Sled dogs of Siberian hunters relish the meat of the frozen mammoths, but the hunters themselves say it tastes far from fresh. These could be the very same mammoths that were hunted by cave men and whose pictures they inscribed on their cave walls. Less complete specimens of frozen mammoths have been found in Alaska.

The famous Northern Mammoth is just one of several kinds of mammoth, many others having been larger and some having gone as far south as Central America.

People often think that these prehistoric elephants were much larger than the ones of today. That is true of only a few kinds. The Northern Mammoth, who was small as mammoths go, was about the same size or even smaller than our African elephants. He had a short, tall body and his head was high-crowned, while the smaller American Mastodon had a long, low body.

Through the ages there have been a number of kinds of mastodons, but the American Mastodon is the one that was common here about the time of the glacier.

It is not unusual to find mastodon bones, although to find a complete skeleton is still worthy of excitement. Many of the huge beasts were trapped in marshes and peat bogs, and the best preserved are most frequently found in such places today. Some of the bones of these animals are in such excellent condition that the original oils ooze out when the bones are drilled. A mass of long coarse woolly hair was found in a swamp with one skeleton; so the mastodon may have had a coat similar to that of the mammoth.

It is not easy to explain the disappearance of the mammoths and mastodons. Although they had become adapted to a variety of climates, their survivors are confined to semi-tropical areas. Their large size and the resulting difficulty in finding sufficient food within traveling distance may have been important factors.

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SOME FOSSILS OF THE CHICAGO REGION

by

WINONA HINKLEY

Raymond Foundation



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November 16, 1946

Some Fossils of the Chicago Region

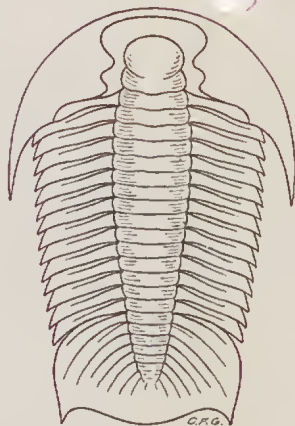
Fossils found in the Chicago area come from one of two sources. Those near the surface in loose earth and rocks are called "drift fossils." They were brought here by the glacier some twenty thousand years ago. Those embedded in the solid limestone rock farther beneath us are the ones described here. They are the remains of animals that lived in the ocean which covered this area some 400 million years ago. Most of these fossils are not the actual remains of the original animals;

they are casts formed when mud or mineral matter filled in the imprints their bodies left in the mud which later became the limestone quarries. You may even find some in gravel that came from these quarries.



←Crinoid or "Sea Lily"

This flower-like animal was really much like a starfish with its back turned down and a thick jointed stem beneath to hold it fast. Most of them were a foot or two in length, but one seventy-foot fossil has been found. Perfect fossils are rare, but you will often find sections of stems or the heads. It was thought that these animals had long been extinct until some living ones were brought up by a dredge about sixty years ago.

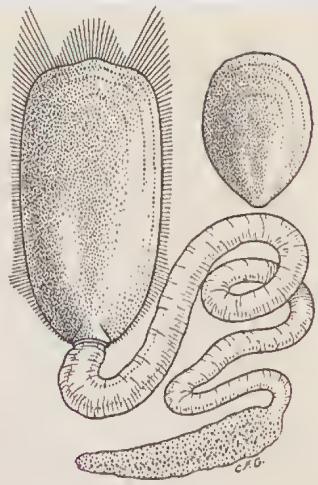


Trilobite →

For thousands of years, the dominant animals on earth were the trilobites, marine animals something like the shrimps today. They were perhaps the most intelligent animals of their time; and though the Chicago ones were about two inches long, some grew to be two feet in length. They had a horny shell which was shed as the animal outgrew it.

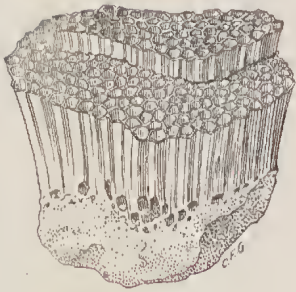
Brachiopod →

A few of these two-shelled animals live today, but in prehistoric times there were thousands of them. The two shells are unequal in size and do not have the same shape. Because the hard shells lend themselves readily to preservation, there are many brachiopod fossils.



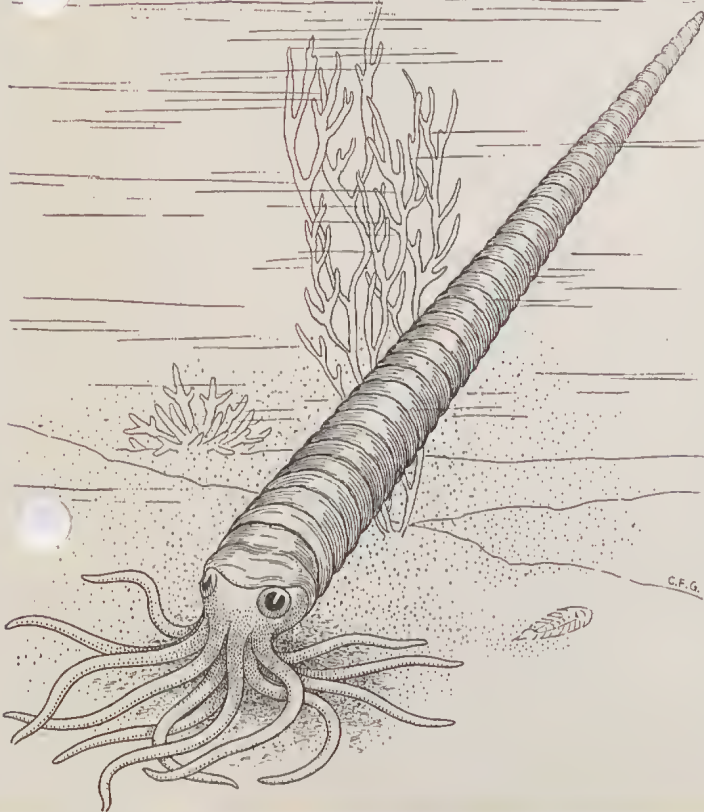
←Corals

Many kinds of corals are to be found both alive in warm oceans and as fossils where there once were warm oceans. The first corals were solitary animals known as cup corals or horn corals. Later many of them lived in colonies and built great coral reefs. Some of the hills in Chicago are really old coral reefs.



Cephalopod

↓ The masters of the sea that covered Chicago were among the cephalopods, which were anywhere from the size of a pipe stem to great animals fifteen feet long and one foot around. The early ones had straight shells, but later they became coiled, so that movement in the ocean was probably much easier. There are no straight-shelled cephalopods living today, but several of their relatives are the coiled chambered nautilus and the octopus and squid.



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PLANTS AND ANIMALS OF THE ICE AGE

by

WINONA HINKLEY
Raymond Foundation

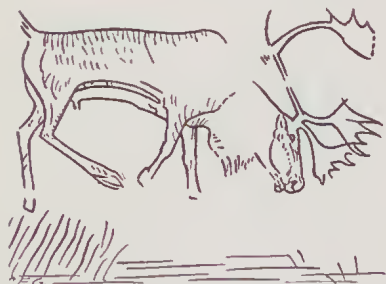


Museum Stories, Number 138

November 23, 1946

Plants and Animals of the Ice Age

Four times in the past, great glaciers have come down over much of the earth. In order to cover the territory they invaded, each must have been several miles thick at its origin in the north. Ice-capped Greenland reminds us



This sketch of a reindeer was found on the wall of a cave in Europe

that the last glacier has not completely disappeared, and even now we may be living in another interglacial age. No higher forms of life could exist on the icy glacier itself, and the climate in its vicinity was rigorous.

However, thousands of years elapsed between each great glacial advance, and during these periods there were many changes of climate, which included semi-tropical and desert conditions. During this time, Europe and North America had forms not only much like those now native south of the equator but also those of the far north. Many kinds of animals living in the Ice Age have themselves disappeared, but most of them were related to similar forms now living. Some of these animals were the mammoth, mastodon, woolly rhinoceros, giant sloth, reindeer, cave bear, giant beaver, peccary, tapir, hare, skunk, wolf, and a large bison with a horn spread of six feet. That the early cave men of Europe were familiar with many of the animals that lived before the last glacier appeared is proven in the drawings found on their cave walls (see sketch).

The plants, too, were the higher forms that live today, and the forests must have been similar to the ones we know. The maple, alder, redbud, locust, osage orange, walnut, and spruce are some of the familiar trees whose remains date back to the Ice Age.

As each of the four glaciers appeared, the animals of the region moved out of its way ahead of it. At the height of each advance the life of the northern hemisphere must have been greatly reduced, as the animals were forced to crowd into regions already occupied. That these enforced migrations were extensive is shown in the presence of musk-ox and woolly mammoth remains in Arkansas and Kentucky and of walrus bones as far south as Georgia. In Europe the reindeer and Arctic fox were driven as far as the Mediterranean Sea.

Then as the ice sheets receded, both the plant and animal life could expand into newly uncovered territory. Life's struggles eased as there was room in which to spread. The animals that stayed closest to the glacier at all times were the northern mammoth, woolly rhinoceros, reindeer, musk-ox, and others whose true homes are in the cold north. Farther from the glacier wild horses, zebras, and camels roamed the American plains, but all became extinct here long before the first white men reached our shores. The ones living today are descended from those who had found their way to South America or to Asia before the Ice Age set in. The wild horses the Indians used were descendants of those brought over by the Spaniards.

Animals and plants now found in Africa and South America abounded north of the equator. European rocks yield the bones of the lion, rhinoceros, hippopotamus, elephant, and antelope; while in the United States the mastodon, sloth, peccary, and tapir were among those to find the climate satisfactory. Then as the climate cooled off with the approach of the returning glacier, these animal populations gradually were pushed southward and into another intense struggle for existence. The last glacier left this area about twenty thousand years ago, and since then, the biggest changes in animal life have been the extinction of a number of forms including the great bison, reindeer, and mastodon.

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COLLECTING FOSSILS

by

MIRIAM WOOD

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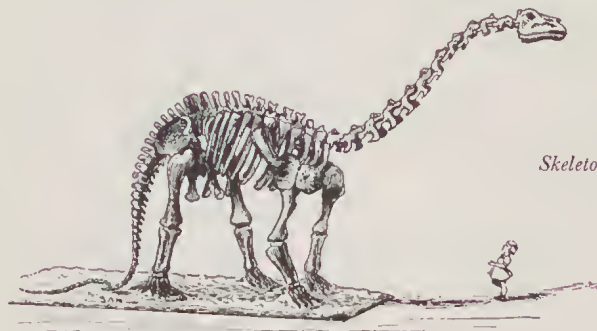


Museum Stories, Number 139

November 30, 1946

Collecting Fossils

There are many kinds of fossils to collect, from the largest of the dinosaurs down to the smallest microscopic animals and plants; and there are almost as many ways of collecting them. Some fossils are found purely by



Skeleton of a dinosaur

accident by people who have little knowledge of fossils and how they should be collected; others are picked up by fossil hunters who collect them as a hobby; but the most of the fossils are found by trained collectors who know approximately where to go to get certain types of fossils and how to collect them.

It makes little difference who collects the fossils if complete information is given with each specimen as to exactly where it was found and how far from the surface. The fossil should also be removed from the rock without breaking it if possible.

Around the Chicago region many kinds of fossils can be found in limestone quarries where the rocks which normally would be many feet under ground are brought to the surface. Here one can poke around among the broken rock fragments and find countless erinoid stems, sometimes in cross-section, sometimes sticking out like little needles, and sometimes partly embedded and looking like tiny threads. Trilobites, corals, and cephalopods are easy to find, too. But, remember, they are very small. Once in a great while

a fossil of a vertebrate (back-boned) animal may be found.

Museum collectors in this part of the country follow these general rules in removing fossils from the earth and rocks: (1) If the fossil is found in solid limestone, which is very hard, the entire rock with the fossil in it can be lifted from the surrounding rocks, crated in burlap or other wrappings, and shipped to the Museum, where the fossils are carefully chipped from the rock.

(2) If the fossil of a back-boned animal is found in softer rocks which are apt to crumble or break, then the fossil is partly uncovered and treated with thin coats of shellac which goes into all the cracks and pores. This hardens and gives the fossil considerable strength; when the shellac dries, the uncovered part of the fossil is bandaged in tissue paper and burlap, and dipped in wet plaster of Paris. This dries into a hard and very strong protective coat. Now the other side of the fossil can be removed from the surrounding rock, treated in the same manner, and thus completely wrapped, shipped to the Museum. In the Museum work shop it is unwrapped and completely cleaned off; if parts are broken, they are pieced together. Frequently, a part will be missing entirely and will have to be reconstructed.

(3) Fossil invertebrates (animals without backbones), which are much smaller and less easily crushed, seldom require any protective coat. They should, however, be chipped from the rocks as carefully as possible in order not to break the fossils themselves and be wrapped individually in paper before shipping to the Museum.



A fossil crinoid stem

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